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(54) Composite dental post

(57) A dental post made of reinforced composite material comprises a central filament or yarn around which a synthetic resin is formed. The central filament or yarn may be made of metal or plastics, ceramic, carbon, graphite, aluminium or silica oxide, quartz or high silica fibre. the synethetic resin around the central filament or yarn may comprise fibres. The central filament may be treated with a biocompatible release agent. Such an arrangement allows the central filament to be extracted facilitating removal of the remainder of the post. The composite post may be made by winding, pultrusion, injection moulding or braiding.

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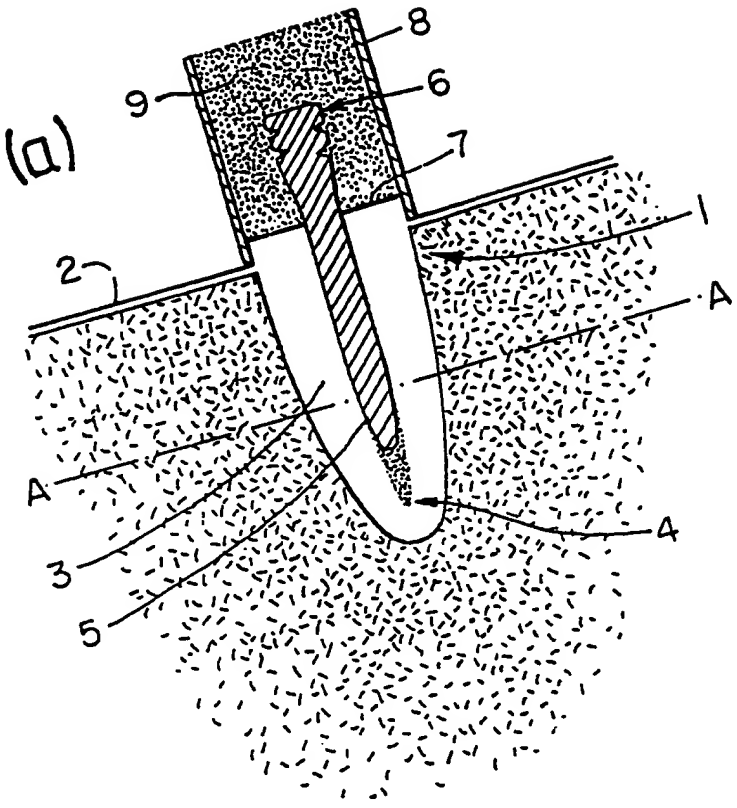
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

FIG.1.



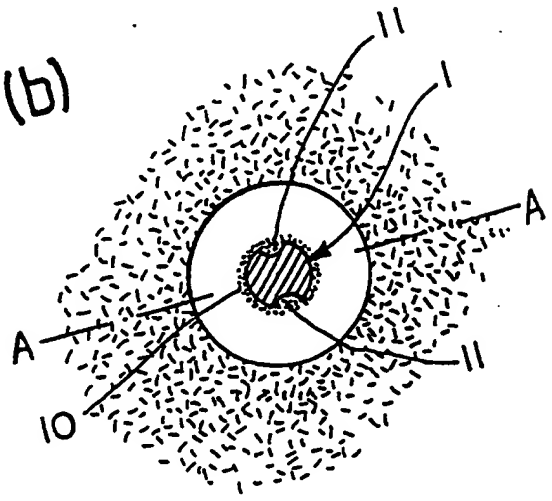


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FIG. 2.

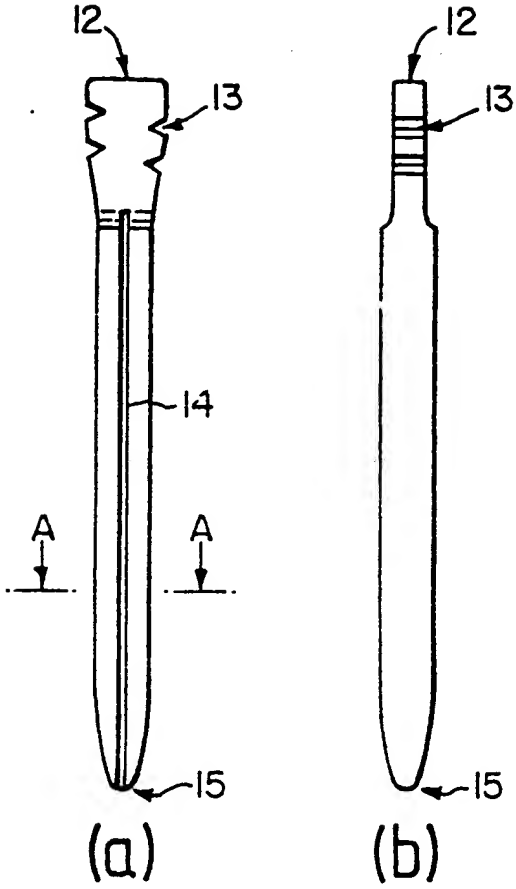

FIG. 3.

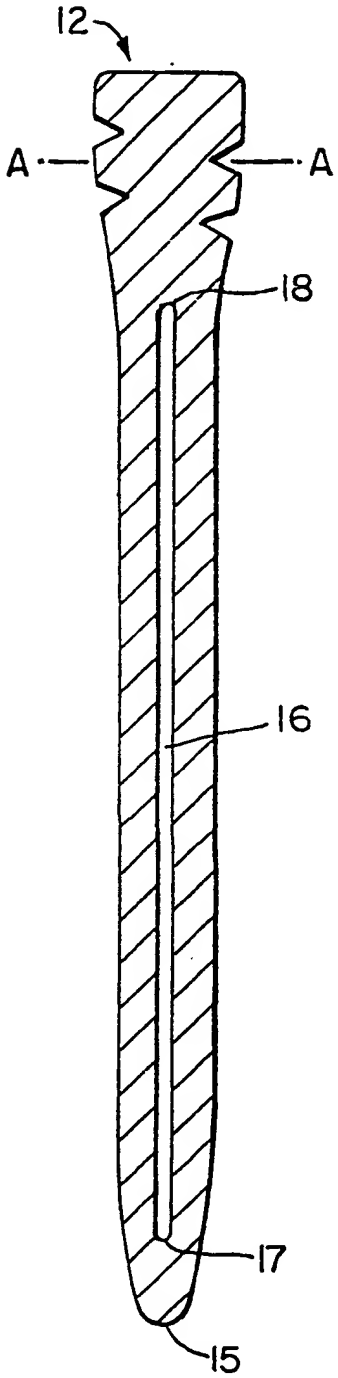

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FIG.4.

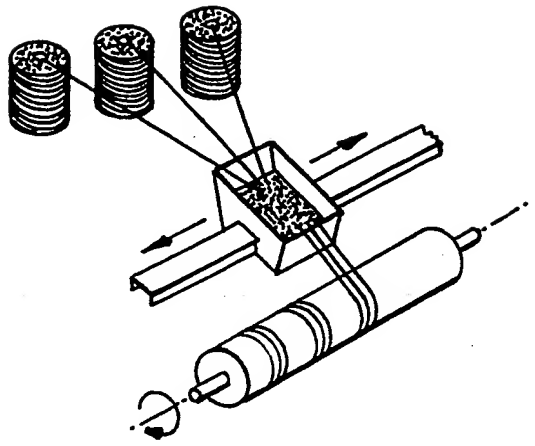
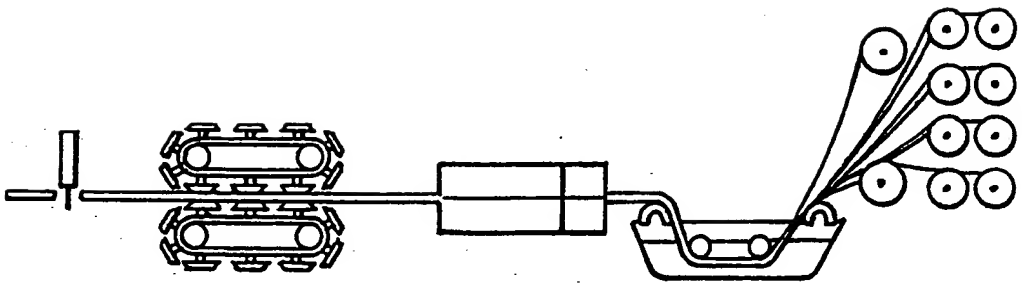


FIG.5.



DENTAL POST

The present invention relates to a dental post and to methods for its production. More particularly the invention relates to a dental post made of reinforced composite material.

Dental posts of the type herein described, are used in everyday dental surgery in order to restore teeth structures which have become damaged. Such a restored tooth is schematically shown in Fig. 1. Figure 1(a) shows a cross-section of a tooth, generally indicated by numeral 1, which has been restored, after the loss of the clinical crown (upper tooth portion), slightly above the gum line 2. The tooth root 3 has a main root canal 4 which has been endodontically treated. The treated root canal 4 houses the dental pin or post 5, which is firmly connected to the walls of the root canal by means of cement or other bonding material.

The head 6 of the post 5 protrudes through the damaged tooth line 7 and constitutes the basis for the restoration of the damaged tooth. A matrix 8 is filled with core material 9. After the core preparation comes to end, the newly built core is covered by an artificial crown, thereby completing the restoration of the tooth.

Fig. 1 (b) is a cross section of the tooth of Fig. 1(a), taken along the AA horizontal plane. In this figure the cement 10 surrounding the dental post 1 is clearly seen. Also two grooves 11 are shown, which will be

discussed hereinafter.

Dental posts of the kind shown in Fig. 1 are in use in everyday dental practice, and the dental posts known in the art are made of metals. Some of the dental posts of the art present several drawbacks, which are obviated in the post of the present invention, as will be apparent from the following description.

It is an object of the present invention to provide a dental post having improved mechanical and other characteristics.

It is another object of the invention to provide processes by means of which the dental posts of the invention can be conveniently produced.

It has been found, and this is another object of the present invention, that it is possible to exploit the unique composite nature of the post of the invention, to provide a dental post which can be easily removed by the dental surgeon, with minimal or no damage to the tooth.

It is another object of the invention to provide a dental post which, while retaining its strength properties, can be dismantled and removed quickly and easily.

As will be apparent to a person skilled in the art, the ability to remove

a post which has been firmly and finally cemented in the tooth represents a considerable improvement over the dental posts known in the art. Dental posts of the art are made of metal, and their removal is difficult, laborious, and hazardous to the tooth. However, the need for non-planned further repairs to the treated tooth makes it necessary in some cases to remove the dental post.

The invention provides a very convenient solution of this problem, as will be appreciated from the following description.

The dental post made of reinforced composite material according to the invention is characterized in that it comprises a substantially central filament or yarn around which a synthetic resin is cast, the said synthetic resin preferably embodying fibers. According to a preferred embodiment of the invention, the surrounding fibers and/or synthetic resin are not bonded to the central filament.

While such fibers can be present in a number of different ways in the composite material, according to a preferred embodiment of the invention the fibers are wound around the central filament or yarn. Such central filament, however, is not necessary when the dental post of the invention is produced according to the pultrusion or injection molding processes. The said fibers are impregnated with resin. The resin enables bonding between the fibers and the central filament, and between the fibers and themselves.

The fiber embodied in the synthetic resin is preferably selected from among polyethylene, particularly HP-PE (high-performance polyethylene), polypropylene, particularly HP-PP (high performance polypropylene) ceramic, carbon, graphite, Nextel 312, Nextel 440, Al_2O_3, quartz, glass, high silica, SiO_2 or Kevlar.

The central filament or yarn, which is conveniently made of a metal, according to another preferred embodiment of the invention can also be made of a fiber selected from among the above-mentioned fibers. When a non-metallic central filament is employed, however, other means must be employed to insure the radio-opacity of the dental post, so that it can be identified by X-ray. This can be obtained, as will be understood by the skilled engineer, by adding radio-opaque fillers to the synthetic resin.

According to a preferred embodiment of the invention, the weight ratio between the fiber and the synthetic resin is of between about 55:45 and 75:25. While the ratio between the fiber and the synthetic resin can be determined in each case by the skilled engineer, based on the desired material strength requirements, the above-indicated values are those generally useful for this purpose.

The diameter of the central filament should be comprised between about 0.1 to 0.5 mm. A more preferred diameter range is between 0.2-0.4 mm. The purpose of the central filament is to provide sufficient strength for the dental post. Therefore, the diameter of the central filament will be dictated in each case by the desired properties of the post employed.

When a metal is employed, a preferred metal will be selected from the biocompatible stainless steels and titanium alloys. Preferred stainless steels comprise the 300 or the 400 SS series and the heat treatable PH stainless steels.

The synthetic resin may be any resin which can suitably be used to form a body made of composite material, such as the dental post of the invention, as long as the resin employed is bio-compatible. Preferred synthetic resins are the acrylic, polyethylene, polypropylene, polycarbonate, epoxy, polysulfone, BISGMA resins, Nylon 6 or isosite.

According to a preferred embodiment of the invention the central filament is treated with a bond-release agent. Thus, when it is desired to remove the post, the central filament is exposed and pulled out with relative ease. The remaining surrounding fibers and synthetic material can then be easily drilled out.

According to another preferred embodiment of the invention, the central filament is coated with a material having a low static friction coefficient. Thus, removal of the central filament is thus aided by the reduction of the resistance offered by the filament against pulling.

According to another preferred embodiment of the invention, the central filament is coated with a release material selected from Teflon based or silicon based materials.

Preferably, the length of the central filament is less than the total length of the post. This permits to adjust the length of the post, without exposing the central filament.

The dental post according to the invention, should possess mechanical properties which render it suitable to withstand the stresses applied to it by the act of chewing. In particular, it should have a double shear load of at least 10 kg for a 1 mm diameter post, as measured according to ASTM B565-76. Normally, however, double shear loads much higher, e.g., 50 kg, can be achieved with the post of the invention.

According to a preferred embodiment of the invention, the dental post is provided with at least one groove for excessive cement escape and for the prevention of rotation of the post, the said groove(s) being substantially parallel to the axis of the dental post.

Such a dental post is schematically shown in Fig. 2. Fig. 2(a) shows one side of the dental post, in which the flat side of the post head 12 is shown. This flat head, as well as the grooves 13, are provided in this preferred embodiment, for ease of handling by the dental surgeon. These characteristics, however, are not essential to the invention, as will be understood by the skilled person. At least one groove 14 is provided in the post. This groove has two purposes: it permits excess cement venting during cementation, thereby diminishing residual stresses, and it fixes the position of the post in the root, preventing its rotation therein. The

post further has a hemispherically shaped end 15 or a bullet-shaped end 15, as customary in posts used for this purposes, which helps prevent excessive stresses on the root canal walls and the apical region.

Fig. 2(b) shows the post of Fig. 2(a), rotated by 90°, viz., with the thin part of the head in full view. Fig. 2(c) is an upper view of a cross-section of the post of Fig. 2(a), taken along the AA plane. In Fig. 2(c) the central filament 16, can be clearly seen. Also, according to this particular embodiment of the invention, two vent grooves 14 are provided.

Fig. 3 shows a cross-section of a dental post with removable central filament, according to a preferred embodiment of the invention.

The central filament 16 is clearly seen in the figure. The lower end 17 of the filament 16 is located approximately 1-2 mm above the extremity 15 of the hemispherically-shaped end of the post, thus allowing for minor length adjustments. The upper end 18 of the central filament is also positioned about 1-2 mm below the upper portion of the post head 12. This avoids nonintentional exposure of the central filament during corono-radicular reabilitation of the tooth.

When it is desired to remove the post, the post head 12 is drilled out until the upper end 18 of the central filament 16 is reached, the central filament is pulled out, and the rest of the post is drilled out, conveniently using the empty central filament canal as the drilling

axis.

The dental post according to the invention may be produced by several methods and processes known in the art. Preferred processes are pultrusion, braiding, filament winding and injection molding. These methods are well known to the man of the art, and will therefore not be discussed in detail.

However, a brief description of four preferred production methods will be given hereinafter, for the sake of clarity.

Filament Winding

According to the filament winding process, the fibers are wound onto a rotating mandrel from a stationary position, as shown in Fig. 4. The rotating mandrel, in the case of the post of the invention, will be the central filament. The fibers are dispensed from a translating head at controlled angles, which permit optimization of the mechanical properties. The warp angle may vary from low angle "longitudinals" to high angle "hoops", approaching 90°, to the mandrel axis. In "wet winding" the resin is applied during the winding stage. In the dry winding method the fibers are pre-impregnated. Curing can be carried out at room or elevated temperature without pressurization.

Pultrusion

The pultrusion technique permits to manufacture structural profiles, such as the post of the invention, from composites and on a continuous

basis. This process is schematically shown in Fig. 5. The fibers and the central filament are pulled and oriented to the designed angle which allows for the optimization of mechanical properties. The dry oriented fiber package is continuously formed on a cylindrical mandrel. Then the oriented fiber package is impregnated by pumping the resin through the package. Excess resin drains back into the sump, and the impregnated package is passed to a forming die for obtaining the desired final shape (post shape). The curing process can be done either at room or high temperature.

Injection Molding

The injection molding process permits to manufacture finished composite posts automatically and at high output rates. According to this process the fibers are chopped and then blend with the resin. The mixture is heated until the resin is melted and the mixture is then injected under high pressure to a cold closed mold. The high pressure injection is caused by the forward acting screw ram. The resin cools rapidly in the mold under continuing pressure of the screw ram. The cooled finished post is then removed from the mold.

Braiding

Braiding is a rapid reinforcement-forming process. In this technique fibers are laid over the central filament, interwoven to tubular shape. The fibers can be dry, wet, or prepreg. In case of dry fibers braiding, the resin is impregnated later either by transfer molding or by other suitable techniques. In case of wet braiding the cure can be made at room

temperature, or by a hot process. In case prepreg braiding is chosen, the cure can be made in an oven or in autoclave. The braiding process can be combined with poltrusion.

Final post shape: The final post shape in each production method can be achieved either by machining or by die shaping, or by both methods.

According to a preferred embodiment of the invention, the final post shape is imparted by hot die. During this process both ends of the post are formed by surplus resin, forming the filament free extremities. The porosity of the material is control to the lowest possible value which preferably should not exceed 3%.

The surface of the post is also of importance in the optimal functioning of the dental post. This makes it advantageous to perform surface treatments of the post. Such surface treatment are well known to the skilled engineer, and include, e.g., sand or glass bead blasting, fine sand paper roughening, in order to roughen the surface, and the cleaning of the roughened surface with a solvent, water or other cleaning technique to insure optimal adhesion.

As will be apparent to the person skilled in the art, the dental post of the invention possesses improved characteristics and provides important advantages which are not present in conventional posts. For instance, the composite material of which the post is made provides a superior bonding to the surrounding cement. The shear load of the cement

bonding to the composite surface is much higher than the corresponding one to a metal surface, such as titanium or stainless steel, of which the dental posts of the art are made. Additionally, the strength of the bond and the ease of installation can diminish installation stresses, which are often responsible for root splitting in conventional posts. Also, the post can be relatively easily removed by drilling, which cannot be easily done with posts made of hard metal.

The above description has been given for the purpose of illustration and is not meant to constitute a limitation. Many different embodiments of the invention can be provided. For instance, different construction materials and methods can be employed and many anti-bond materials or friction-reducing materials can be employed as coatings for the central filament, all without exceeding the scope of the invention.

CLAIMS:

1. A dental post made of reinforced composite material, characterized in that it comprises a substantially central filament or yarn around which a synthetic resin is cast, the said synthetic resin preferably embodying fibers.

2. A dental post according to claim 1, in which the synthetic resin comprises fibers.

3. A dental post according to claim 2, wherein the fibers are wound around the central filament or yarn.

4. A dental post according to claim 3, wherein the fiber is selected from among polyethylene HP-PE, polypropylene HP-PP, ceramic, carbon, graphite, Nextel 312, Nextel 440, Al_2O_3, quartz, glass, high silica, SiO_2 and Kevlar.

5. A dental post according to claims 1 to 4, wherein the central filament or yarn is made of a fiber selected from among polyethylene HP-PE, polypropylene HP-PP, ceramic, carbon, graphite, Nextel 312, Nextel 440, Al_2O_3, quartz, glass, high silica, SiO_2 and Kevlar.

6. A dental post according to claims 1 to 4, wherein the central filament or yarn is made of metal.

7. A dental post according to claim 6, wherein the metal is selected from stainless steel and titanium alloys, the stainless steel being preferably selected from the 300 or the 400 SS series and the biocompatible heat treatable PH stainless steels.

8. A dental post according to claim 1, wherein the weight ratio between the fiber and the synthetic resin is between about 55:45 and 75:25.

9. A dental post according to claim 8, wherein the diameter of the central filament is of about 0.1 to 0.5 mm.

10. A dental post according to claim 9, wherein the synthetic resin is a polyethylene, polypropylene, acrylic, polycarbonate, epoxy, polysulfone or BISGMA resin, or Nylon 6 or isosite.

11. A dental post according to claim 1, having a double shear load of at least 10 kg for 1 mm diameter post, measured according to ASTM B565-76.

12. A dental post according to claim 1, characterized in that it is provided with at least one groove for excessive cement escape and for the prevention of rotation of the post, the said groove(s) being substantially parallel to the axis of the dental post.

13. A dental post according to claim 1, characterized in that the surrounding fibers and/or synthetic resin are not bonded to the

central filament.

14. A dental post according to claim 1, wherein the central filament is treated with biocompatible bond-release agents.

15. A dental post according to claim 14, wherein the central filament is coated with a material having a low static friction coefficient.

16. A dental post according to claim 15, wherein the central filament is coated with a release material made of Teflon or silicon base.

17. A process for producing a dental post according to claim 1. selected from among the poltrusion and braiding methods.

18. A dental post according to claim 1, whenever produced by a method of claim 17.

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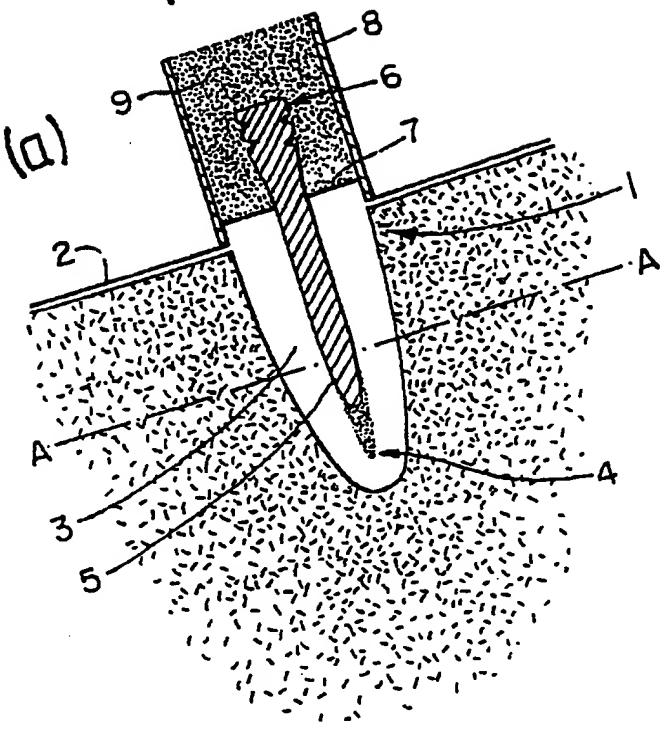
FIG.1.



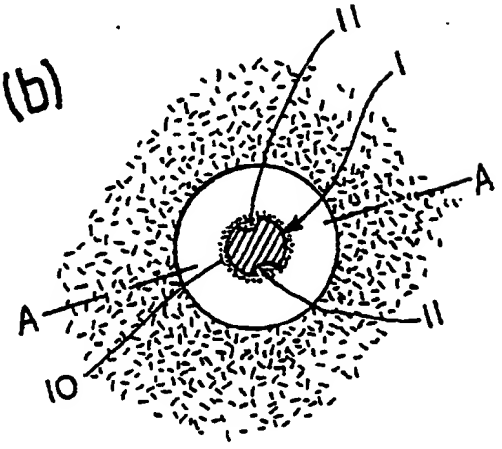


FIG.2.

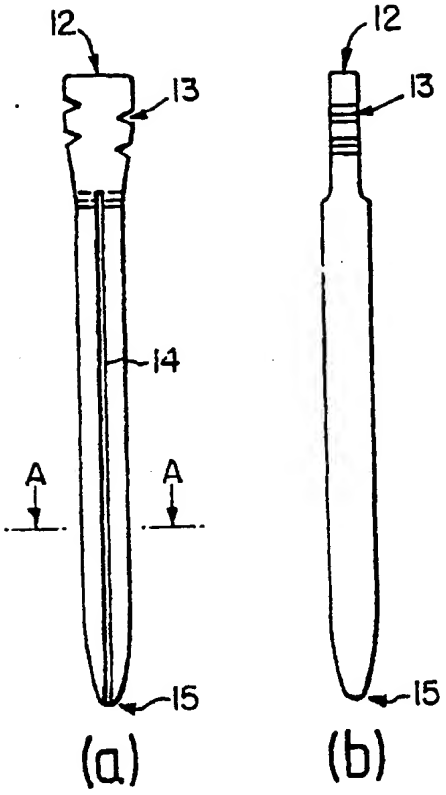


FIG.3.

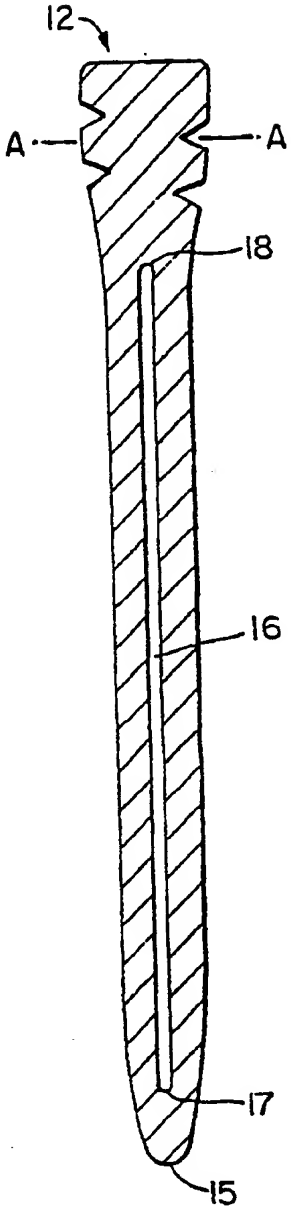


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FIG.4.

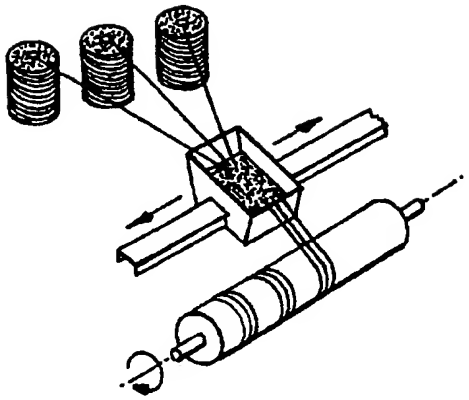
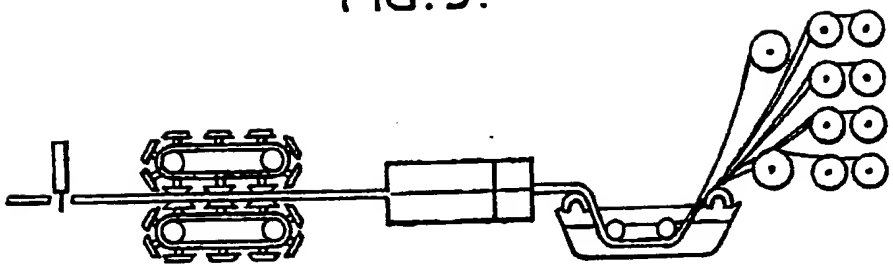


FIG.5.



DENTAL POST

The present invention relates to a dental post and to methods for its production. More particularly the invention relates to a dental post made of reinforced composite material.

Dental posts of the type herein described, are used in everyday dental surgery in order to restore teeth structures which have become damaged. Such a restored tooth is schematically shown in Fig. 1. Figure 1(a) shows a cross-section of a tooth, generally indicated by numeral 1, which has been restored, after the loss of the clinical crown (upper tooth portion), slightly above the gum line 2. The tooth root 3 has a main root canal 4 which has been endodontically treated. The treated root canal 4 houses the dental pin or post 5, which is firmly connected to the walls of the root canal by means of cement or other bonding material.

The head 6 of the post 5 protrudes through the damaged tooth line 7 and constitutes the basis for the restoration of the damaged tooth. A matrix 8 is filled with core material 9. After the core preparation comes to end, the newly built core is covered by an artificial crown, thereby completing the restoration of the tooth.

Fig. 1 (b) is a cross section of the tooth of Fig. 1(a), taken along the AA horizontal plane. In this figure the cement 10 surrounding the dental post 1 is clearly seen. Also two grooves 11 are shown, which will be

discussed hereinafter.

Dental posts of the kind shown in Fig. 1 are in use in everyday dental practice, and the dental posts known in the art are made of metals. Some of the dental posts of the art present several drawbacks, which are obviated in the post of the present invention, as will be apparent from the following description.

It is an object of the present invention to provide a dental post having improved mechanical and other characteristics.

It is another object of the invention to provide processes by means of which the dental posts of the invention can be conveniently produced.

It has been found, and this is another object of the present invention, that it is possible to exploit the unique composite nature of the post of the invention, to provide a dental post which can be easily removed by the dental surgeon, with minimal or no damage to the tooth.

It is another object of the invention to provide a dental post which, while retaining its strength properties, can be dismantled and removed quickly and easily.

As will be apparent to a person skilled in the art, the ability to remove

a post which has been firmly and finally cemented in the tooth represents a considerable improvement over the dental posts known in the art. Dental posts of the art are made of metal, and their removal is difficult, laborious, and hazardous to the tooth. However, the need for non-planned further repairs to the treated tooth makes it necessary in some cases to remove the dental post.

The invention provides a very convenient solution of this problem, as will be appreciated from the following description.

The dental post made of reinforced composite material according to the invention is characterized in that it comprises a substantially central filament or yarn around which a synthetic resin is cast, the said synthetic resin preferably embodying fibers. According to a preferred embodiment of the invention, the surrounding fibers and/or synthetic resin are not bonded to the central filament.

While such fibers can be present in a number of different ways in the composite material, according to a preferred embodiment of the invention the fibers are wound around the central filament or yarn. Such central filament, however, is not necessary when the dental post of the invention is produced according to the pultrusion or injection molding processes. The said fibers are impregnated with resin. The resin enables bonding between the fibers and the central filament, and between the fibers and themselves.

The fiber embodied in the synthetic resin is preferably selected from among polyethylene, particularly HP-PE (high-performance polyethylene), polypropylene, particularly HP-PP (high performance polypropylene) ceramic, carbon, graphite, Nextel 312, Nextel 440, Al_2O_3, quartz, glass, high silica, SiO_2 or Kevlar.

The central filament or yarn, which is conveniently made of a metal, according to another preferred embodiment of the invention can also be made of a fiber selected from among the above-mentioned fibers. When a non-metallic central filament is employed, however, other means must be employed to insure the radio-opacity of the dental post, so that it can be identified by X-ray. This can be obtained, as will be understood by the skilled engineer, by adding radio-opaque fillers to the synthetic resin.

According to a preferred embodiment of the invention, the weight ratio between the fiber and the synthetic resin is of between about 55:45 and 75:25. While the ratio between the fiber and the synthetic resin can be determined in each case by the skilled engineer, based on the desired material strength requirements, the above-indicated values are those generally useful for this purpose.

The diameter of the central filament should be comprised between about 0.1 to 0.5 mm. A more preferred diameter range is between 0.2-0.4 mm. The purpose of the central filament is to provide sufficient strength for the dental post. Therefore, the diameter of the central filament will be dictated in each case by the desired properties of the post employed.

When a metal is employed, a preferred metal will be selected from the biocompatible stainless steels and titanium alloys. Preferred stainless steels comprise the 300 or the 400 SS series and the heat treatable PH stainless steels.

The synthetic resin may be any resin which can suitably be used to form a body made of composite material, such as the dental post of the invention, as long as the resin employed is bio-compatible. Preferred synthetic resins are the acrylic, polyethylene, polypropylene, polycarbonate, epoxy, polysulfone, BISGMA resins, Nylon 6 or isosite.

According to a preferred embodiment of the invention the central filament is treated with a bond-release agent. Thus, when it is desired to remove the post, the central filament is exposed and pulled out with relative ease. The remaining surrounding fibers and synthetic material can then be easily drilled out.

According to another preferred embodiment of the invention, the central filament is coated with a material having a low static friction coefficient. Thus, removal of the central filament is thus aided by the reduction of the resistance offered by the filament against pulling.

According to another preferred embodiment of the invention, the central filament is coated with a release material selected from Teflon based or silicon based materials.

Preferably, the length of the central filament is less than the total length of the post. This permits to adjust the length of the post, without exposing the central filament.

The dental post according to the invention, should possess mechanical properties which render it suitable to withstand the stresses applied to it by the act of chewing. In particular, it should have a double shear load of at least 10 kg for a 1 mm diameter post, as measured according to ASTM B565-76. Normally, however, double shear loads much higher, e.g., 50 kg, can be achieved with the post of the invention.

According to a preferred embodiment of the invention, the dental post is provided with at least one groove for excessive cement escape and for the prevention of rotation of the post, the said groove(s) being substantially parallel to the axis of the dental post.

Such a dental post is schematically shown in Fig. 2. Fig. 2(a) shows one side of the dental post, in which the flat side of the post head 12 is shown. This flat head, as well as the grooves 13, are provided in this preferred embodiment, for ease of handling by the dental surgeon. These characteristics, however, are not essential to the invention, as will be understood by the skilled person. At least one groove 14 is provided in the post. This groove has two purposes: it permits excess cement venting during cementation, thereby diminishing residual stresses, and it fixes the position of the post in the root, preventing its rotation therein. The

post further has a hemispherically shaped end 15 or a bullet-shaped end 15, as customary in posts used for this purposes, which helps prevent excessive stresses on the root canal walls and the apical region.

Fig. 2(b) shows the post of Fig. 2(a), rotated by 90°, viz., with the thin part of the head in full view. Fig. 2(c) is an upper view of a cross-section of the post of Fig. 2(a), taken along the AA plane. In Fig. 2(c) the central filament 16, can be clearly seen. Also, according to this particular embodiment of the invention, two vent grooves 14 are provided.

Fig. 3 shows a cross-section of a dental post with removable central filament, according to a preferred embodiment of the invention.

The central filament 16 is clearly seen in the figure. The lower end 17 of the filament 16 is located approximately 1-2 mm above the extremity 15 of the hemispherically-shaped end of the post, thus allowing for minor length adjustments. The upper end 18 of the central filament is also positioned about 1-2 mm below the upper portion of the post head 12. This avoids nonintentional exposure of the central filament during corono-radicular reabilitation of the tooth.

When it is desired to remove the post, the post head 12 is drilled out until the upper end 18 of the central filament 16 is reached, the central filament is pulled out, and the rest of the post is drilled out, conveniently using the empty central filament canal as the drilling

axis.

The dental post according to the invention may be produced by several methods and processes known in the art. Preferred processes are pultrusion, braiding, filament winding and injection molding. These methods are well known to the man of the art, and will therefore not be discussed in detail.

However, a brief description of four preferred production methods will be given hereinafter, for the sake of clarity.

Filament Winding

According to the filament winding process, the fibers are wound onto a rotating mandrel from a stationary position, as shown in Fig. 4. The rotating mandrel, in the case of the post of the invention, will be the central filament. The fibers are dispensed from a translating head at controlled angles, which permit optimization of the mechanical properties. The warp angle may vary from low angle "longitudinals" to high angle "hoops", approaching 90°, to the mandrel axis. In "wet winding" the resin is applied during the winding stage. In the dry winding method the fibers are pre-impregnated. Curing can be carried out at room or elevated temperature without pressurization.

Pultrusion

The pultrusion technique permits to manufacture structural profiles, such as the post of the invention, from composites and on a continuous

basis. This process is schematically shown in Fig. 5. The fibers and the central filament are pulled and oriented to the designed angle which allows for the optimization of mechanical properties. The dry oriented fiber package is continuously formed on a cylindrical mandrel. Then the oriented fiber package is impregnated by pumping the resin through the package. Excess resin drains back into the sump, and the impregnated package is passed to a forming die for obtaining the desired final shape (post shape). The curing process can be done either at room or high temperature.

Injection Molding

The injection molding process permits to manufacture finished composite posts automatically and at high output rates. According to this process the fibers are chopped and then blend with the resin. The mixture is heated until the resin is melted and the mixture is then injected under high pressure to a cold closed mold. The high pressure injection is caused by the forward acting screw ram. The resin cools rapidly in the mold under continuing pressure of the screw ram. The cooled finished post is then removed from the mold.

Braiding

Braiding is a rapid reinforcement-forming process. In this technique fibers are laid over the central filament, interwoven to tubular shape. The fibers can be dry, wet, or prepreg. In case of dry fibers braiding, the resin is impregnated later either by transfer molding or by other suitable techniques. In case of wet braiding the cure can be made at room

temperature, or by a hot process. In case prepreg braiding is chosen, the cure can be made in an oven or in autoclave. The braiding process can be combined with poltrusion.

Final post shape: The final post shape in each production method can be achieved either by machining or by die shaping, or by both methods.

According to a preferred embodiment of the invention, the final post shape is imparted by hot die. During this process both ends of the post are formed by surplus resin, forming the filament free extremities. The porosity of the material is control to the lowest possible value which preferably should not exceed 3%.

The surface of the post is also of importance in the optimal functioning of the dental post. This makes it advantageous to perform surface treatments of the post. Such surface treatment are well known to the skilled engineer, and include, e.g., sand or glass bead blasting, fine sand paper roughening, in order to roughen the surface, and the cleaning of the roughened surface with a solvent, water or other cleaning technique to insure optimal adhesion.

As will be apparent to the person skilled in the art, the dental post of the invention possesses improved characteristics and provides important advantages which are not present in conventional posts. For instance, the composite material of which the post is made provides a superior bonding to the surrounding cement. The shear load of the cement

bonding to the composite surface is much higher than the corresponding one to a metal surface, such as titanium or stainless steel, of which the dental posts of the art are made. Additionally, the strength of the bond and the ease of installation can diminish installation stresses, which are often responsible for root splitting in conventional posts. Also, the post can be relatively easily removed by drilling, which cannot be easily done with posts made of hard metal.

The above description has been given for the purpose of illustration and is not meant to constitute a limitation. Many different embodiments of the invention can be provided. For instance, different construction materials and methods can be employed and many anti-bond materials or friction-reducing materials can be employed as coatings for the central filament, all without exceeding the scope of the invention.

CLAIMS:

1. A dental post made of reinforced composite material, characterized in that it comprises a substantially central filament or yarn around which a synthetic resin is cast, the said synthetic resin preferably embodying fibers.

2. A dental post according to claim 1, in which the synthetic resin comprises fibers.

3. A dental post according to claim 2, wherein the fibers are wound around the central filament or yarn.

4. A dental post according to claim 3, wherein the fiber is selected from among polyethylene HP-PE, polypropylene HP-PP, ceramic, carbon, graphite, Nextel 312, Nextel 440, Al_2O_3, quartz, glass, high silica, SiO_2 and Kevlar.

5. A dental post according to claims 1 to 4, wherein the central filament or yarn is made of a fiber selected from among polyethylene HP-PE, polypropylene HP-PP, ceramic, carbon, graphite, Nextel 312, Nextel 440, Al_2O_3, quartz, glass, high silica, SiO_2 and Kevlar.

6. A dental post according to claims 1 to 4, wherein the central filament or yarn is made of metal.

7. A dental post according to claim 6, wherein the metal is selected from stainless steel and titanium alloys, the stainless steel being preferably selected from the 300 or the 400 SS series and the biocompatible heat treatable PH stainless steels.

8. A dental post according to claim 1, wherein the weight ratio between the fiber and the synthetic resin is between about 55:45 and 75:25.

9. A dental post according to claim 8, wherein the diameter of the central filament is of about 0.1 to 0.5 mm.

10. A dental post according to claim 9, wherein the synthetic resin is a polyethylene, polypropylene, acrylic, polycarbonate, epoxy, polysulfone or BISGMA resin, or Nylon 6 or isosite.

11. A dental post according to claim 1, having a double shear load of at least 10 kg for 1 mm diameter post, measured according to ASTM B565-76.

12. A dental post according to claim 1, characterized in that it is provided with at least one groove for excessive cement escape and for the prevention of rotation of the post, the said groove(s) being substantially parallel to the axis of the dental post.

13. A dental post according to claim 1, characterized in that the surrounding fibers and/or synthetic resin are not bonded to the

central filament.

14. A dental post according to claim 1, wherein the central filament is treated with biocompatible bond-release agents.

15. A dental post according to claim 14, wherein the central filament is coated with a material having a low static friction coefficient.

16. A dental post according to claim 15, wherein the central filament is coated with a release material made of Teflon or silicon base.

17. A process for producing a dental post according to claim 1. selected from among the poltrusion and braiding methods.

18. A dental post according to claim 1, whenever produced by a method of claim 17.

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